REMARKS

Claim 1 relates to a crystalline polyester having: 1) a number-average molecular weight of from 5000 to 10000, 2) a weight -average molecular weight of from 150000 to 8000000, 3) a maximum peak temperature of heat of fusion of from 60° to 150°C, and 4) a ratio of a softening point to a maximum peak temperature of heat of fusion of from 0.6 to 1.3.

In contrast, the reference to Aoki et al. (U.S. Patent No. 6,383,705), alone or combination, does not disclose or suggest a crystalline polyester having a weight-average molecular weight of from 150000 to 8000000; the reference to Shirai et al. (U.S. Patent No. 6,723,822) is not available as prior art; and the reference to Hashimoto et al. (U.S. Patent No. 5,948,584) teaches away from the from the claimed weight-average molecular weight.

Aoki et al. does not disclose or suggest anywhere in the reference's disclosure a crystalline polyester having the weight-average molecular weight, as presently claimed. In particular, Kao Corporation, the owner of the reference (which is the same assignee of the present invention), sought to develop a toner containing a binder resin synthesized solely with the physical properties described in the reference, in which the toner was excellent for "the low temperature fixing ability, the offset resistance, the blocking resistance," etc. (Column 1, lines 55-60).

The Office's attention is drawn to the types of crystalline polyesters disclosed and exemplified by Aoki et al., i.e., Resins A-K in Table 1, of columns 7-8, shown below. Beneath each formulation of every resin recited in Table 1, containing the quantitative proportions of monomeric units for the polyesters, their relevant physical properties are listed. Notice that a value for weight-average molecular weight is not recited in the table, nor anywhere in the reference, since that value was not part of the constructive goals of the invention or implicitly part of achieving those goals.

TABLE 1

	Resin A	Resin B	Resin C	Resin D	Resin E	Resin F	Resin G	Resin H	Resin I	Resin J	Resin K
Ethylene Glycol				124 10					161 13		
1,4-Butanediol	2070 100		1800 100	1620 90	1800 100	1924 95.2	1924 95	1701 90		1530 85	
1,6-Hexanediol		2362 100					133 5		2055 87		2362 100
1,8-Octanediol										438 15	
Hydrogenated Bisphenol A								504 10			
Glycerol						92 4.8					
Fumaric Acid	2535 93.5	2204 100	1972 81	2204 93.5	2088 88.6	2688 100	2480 93.5	2509 100	2320 100	2320 97.8	
Succinic Acid					118 4.9						2360 100
Trimellitic Anhydride	291 6.5		768 19	253 6.5	254 6.5		285 6.5			127 2.2	
Hydroquinone	4.9 g	4.6 g	4.5 g	4.2 g	4.3 g	4.7 g	4.8 g	4.7 g	4.5 g	4.4 g	4.7 g
Softening Point (° C.)	127.3	94.9	104.0	114.3	115.7	128.8	130.8	123.4	106.8	122.3	72.4
Maximum Peak Temperature of Heat of Fusion (° C.)	123.0	91.7	99.9	110.8	115.8	125.8	125.2	122.1	103.2	120.5	68.3
Number-Average Molecular Weight of Tetrahydrofuran-Soluble Component	705	1230	635	951	676	599	765	880	986	667	4120

Note: Unless specified otherwise, the amount on the upper level is expressed in g, and the amount on the lower level is expressed in % by mol in the acid or alcohol component.

The Office alleges that since Aoki et al. discloses a crystalline polyester with a general overlap in other physical properties, such as number-average molecular weight, that the claimed range of weight-average molecular weight would be obvious in view of other references. However, the Office's reasoning is incorrect, since among those properties, number-average and weight-average molecular weights are not the same, and they are not calculated or influenced by the same factors.

For instance, the following two equations represent the ways in which one of ordinary skill in the art would calculate the weight-average molecular weight and number-average molecular weight of polymeric materials. Each equation, based on the arrangement of different elements in each equation, clearly results in a different quantitative value than the other equation.

$\overline{M}_w$ (Weight-Average Molecular Weight)

$$\overline{M}_w = \frac{\sum_{i=1}^{\infty} N_i M_i^2}{\sum_{i=1}^{\infty} N_i M_i}$$

$\overline{M}_n$ (Number-Average Molecular Weight)

$$\overline{M}_n = \frac{\sum_{i=1}^{\infty} M_i N_i}{\sum_{i=1}^{\infty} N_i}$$

(*See* Introduction to Polymer Science and Technology: An SPE Textbook (1977), pp. 162-165, 174-175, and 195, which discloses the values calculations for different types of average molecular weights.) A copy this technical reference is provided with this response for the Office's convenience.

Moreover, it is known that in polymer synthesis the derived value for weight-average molecular weight is significantly different because it is influenced by the presence of high molecular weight species (i.e., a certain proportion of heavier molecules present in the polymeric material), while number-average molecular weight is influenced by the proportion of lower molecular weight species. Thus, while similar polymers may have the same or overlapping number-average molecular weight, weight-average molecular weight may be different, since it is not determined by number-average molecular weight. (*See* Introduction to Polymer Science and Technology: An SPE Textbook, p. 175, explaining that "there appears to be no simple analogy for $\overline{M}_w$ akin to counting molecules to obtain $\overline{M}_n$.") (emphasis added).

In the present invention, Kao Corporation chose to explicitly develop a crystalline polyester that contains a proportion of high molecular weight species of molecules in the polymeric material. The determination of the weight-average molecular weight of the crystalline polyester is significant because Applicants found that the combined properties of low-temperature fixing ability, durability and storage ability are attributed to the presence of a high proportion of the heavier molecules in the crystalline polyester.

As recited in the present specification, "in order to obtain the crystalline polyester of the present invention, it is preferable that the polyester has a high molecular weight, and it is more preferable that the reaction is carried out until the viscosity of the reaction mixture becomes high." (Present specification, page 6, lines 12-15; *see also* Principles of Polymer Chemistry (1995), pp. 308-311, describing the technical relation of viscosity and high

molecular weights, supplied with this response for the Office's convenience). As such, the synthesis of the claimed crystalline polyester was carried out until the existence of a weight-average molecular weight in the claimed range was obtained.

By contrast, Aoki et al. do not recite that the synthesis of their crystalline polyester was preferably extended until there was a resulting high molecular weight. Rather, Aoki et al. explicitly show that a crystalline polyester, at the time of developing that invention for the Kao Corporation, was synthesized specifically to have a proportion of low molecular weight molecules with no mention of the need for a presence of a specific range of heavier molecules, i.e., no weight-average molecular weight of from 150000 to 8000000. Thus, the rejection is improper for at least the reason that Aoki et al. do not disclose or suggest the claimed invention.

Regarding Shirai et al., the reference does not describe a weight-average molecular weight for the disclosed crystalline polyester. Moreover, even if one could selectively associate certain properties disclosed in the reference with the claimed crystalline polyester, which the Office does in the rejection, Applicants submit that this reference is not available as prior art for this rejection. In particular, Shirai et al. qualifies as a reference under 35 U.S.C. § 102(e)/103(c), the inventions have the same assignee (Kao Corporation), and they were commonly owned at the time of the present invention. (MPEP § 2141). Thus, the reference should not have been applied in the rejection.

Regarding Hashimoto et al., the reference does not describe or suggest the claimed invention whatsoever, and thus cannot be combined sufficiently with Aoki et al. to defeat the patentability of the claimed invention. Importantly, the reference recites that the polyesters used in the invention must "have a weight-average molecular weight of **3,000 - 100,000**, in order to provide a toner having particularly excellent performances . . . particularly **3,000 - 30,000** . . . for exhibiting preferred electrophotographic performances." (Column 10, lines

38-47) (emphasis added). These ranges are clearly not within the scope of the present invention and certainly do nothing to improve upon the invention of Aoki et al. Thus, the Office's reliance in the Office Action on Figure 1 of the reference, which merely shows a broad range in molecular weight values (not weight average molecular weight), is incorrect.

In view of the foregoing reasons, Applicants respectfully request the withdrawal of the rejection under 35 U.S.C. § 103(a).

The rejection of claims 1-4 under 35 U.S.C. § 112, first paragraph is respectfully traversed, since the present specification reasonably provides enablement for both number-average molecular weight and weight-average molecular weight.

As recited in the present specification at pages 13-15, average molecular weights were generally determined by a gel permeation chromatography (GPC) procedure. Specifically, from the results of the GPC procedure, which includes molecular weight distribution, the number-average and weight-average molecular weights for each exemplified polymeric (binder resin) sample were calculated. Accordingly, as shown in Tables 1 and 2 of present specification on pages 16-17, the number-average and weight-average molecular weights for each exemplified binder resin sample (Resins a-i) were reported.

For the Office's reference, Applicants include with this response a copy of a technical reference on polymers, which generally shows that GPC is a well known procedure for evaluating molecular weight distribution and molecular weight averages, and recites the implicit calculations involved in the procedure. (*See* Introduction to Polymers (1991), pp. 211-221). In light of this supporting technical evidence and the written description in the present specification, Applicants submit the rejection is improper.

Thus, Applicants request that the rejection under 35 U.S.C. § 112, first paragraph be withdrawn.

Applicants submit the application is now in condition for allowance. Early notification of such allowance is earnestly solicited.

Respectfully submitted,

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